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The Impact of Intellectual Capital on the Performance and Investment Attractiveness of Russian Companies

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Abstract. Recent studies show that intellectual resources, such as highly qualified workforce, well-functioning business processes within the organization and strategic relationships with all stakeholders together give a synergistic effect and are key factors in creating a sustainable competitive advantage. This notion is true for both high-tech companies that are focused on knowledge management and mainly work in the service sector, as well as for traditional industrial-type firms that are focused on creating products using value chain models. The historical growth of intellectual capital is traditionally associated with the trend of increasing market capitalization of firms, which is most clearly observed for companies that use knowledge resources as core competitive advantage. However, in practice the consequences of investing in intellectual capital intensive firms are often not always clear, in particular, there is unambiguous relationship between intellectual capital and the ability of companies to perform sustainably.

In this study proposes models to investigate the impact of the components of intellectual capital on investment attractiveness and therefore potential positive investment decisions for companies using financial indicators such as revenue and market share. The results show a moderate positive relationship between revenue, market share, reflecting the investment attractiveness of the company and qualitative indicators of static and dynamic intellectual capital.

1. Introduction

Growing level of intangible assets recognition in the economic processes development, as well as an understanding of intellectual resources role in shaping the competitive advantage of companies and national economies as a whole, has led to crystallization of a holistic and complex intellectual capital concept, which is one of the most promising areas in modern management theory [1,2]. Intellectual capital in the modern world is perceived as a strategic resource, which requires significant focus of efforts of managers and company's employees. [3]. Due to the increase in the speed of decision-making in the business environment, as well as the increase in the amount of processed information about the external and internal environment, the companies have become much more complicated and the approaches to enterprise management have transformed [4]. Intellectual resources are created by business through training, experience accumulation, research and implementation of technological practically significant developments. [5].

Despite the high impact of qualitative data on current intellectual capital research, analyzing this complex phenomenon at the so-called "third stage" of intellectual capital theory development, requires



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to sustainably apply quantitative data and correspondingly more rigorous empirical models that will allow us to more clearly trace the relationship between the performance of the company and elements intellectual capital [2]. A theoretical analysis shows that investors focus on the financial performance indicators of the company, i.e. the company's ability to generate a continuous stream of income in the future, as well as increase market share [6]. This approach implies that the practical and generally accepted indicators of the company's performance and investment attractiveness linked to the facts that the company (1) succeeded in sales growth in current year compared to competitors, and (or) also (2) increased its market share compared to with some other companies in sector [7].

Researchers also trace a clear correlation between the quality and amount of intellectual resources used by companies and the desire of investors to invest in a company, respectively, increasing the demand for stocks and their market value [5,8,9]. For the first time, the relationship of investment attractiveness and intellectual resources was widely covered in the stream of academic and popular management literature in 1990-s. Representatives of electronic commerce, an information technology company that quickly developed in the market and showed an unprecedentedly high level of return on exploited capital, attracted special attention of investors. Many researchers note that there is a significant relationship between the concepts of commercial company performance and investor interests; therefore, companies seek to increase investment attractiveness by disclosing specific intellectual capital performance indicators and thus creating a more transparent business environment [10–12]. In our study, we use methods of a quantitative analysis to investigate the relationship of investment attractiveness, expressed through revenue and market share and specific indicators of intellectual capital, characterizing the static and dynamic aspects of its accumulation.

2. Intellectual capital and performance: a literature review and hypothesis development

Recent studies based on the natural science quantitative methodology have gained high popularity in intellectual capital research agenda in connection with the expansion of empirical basis that supports the theoretical concept core [13]. Among the models that are used in practice, we can distinguish regression analysis of various statistical data, including those collected by the authors themselves in unique studies, as well as factor analysis methods for grouping indicators of intellectual capital and highlighting their relationship [14–16]. In addition, the introduction of factor analysis, structural equations modeling, which allows us to determine the relationship between complex theoretical structures (especially widely used in sociology), is widely acceptable [14,17].

Previous studies have shown either strong or moderate positive relationship between elements of intellectual capital and company performance. Kujansivu et al. (2007), based on a statistical analysis of financial statements, indicates a strong relationship between the amount of intellectual capital and the performance of Finnish companies, not only in high-tech industries and in the service sector of the economy, but also in gas and electricity companies [18]. Pike et al. (2007) explores the nature of the relationship between the elements of intellectual capital in the process of business-models transformation in the health sector, showing that intellectual capital affects increasing of the companies' effectiveness indirectly [19]. The study is based on a three-component "navigator" of intellectual capital. Cabrita and Bontis (2008) discover a strong relationship between structural capital and the performance of companies in the banking sector of Portugal based on the analysis of structural equations [17]. Andreeva and Garanina (2016) also use structural models to investigate intellectual capital in Russian industry based on an analysis of 240 companies, noting that structural and human capital have a positive effect on performance, while there are no stable significant links between performance and relational capital [14].

The general aim of intellectual capital modeling is to reveal patterns in the management processes, investment in intellectual capital, and performance of the company. Performance is an ability to achieve specific planned results. Due to the complexity and social significance of the intellectual capital elements, various subjective assessments based on a variety of different author's questionnaires are also used in parallel with the traditional financial indicators. As a rule, the content of such studies has the following structure. Firstly, the theoretical premises of the relationship between the elements of

intellectual capital are analyzed: at this stage, previous studies are examined and conclusions are drawn about the presence and difference of concepts from each other. Examples of such concepts include human capital, structural capital, or relational capital [20]. Secondly, the authors analyze the environmental conditions or the peculiarities of the company in a specific industry or country. Obviously, differences in the field of strategies and approaches to intellectual capital management at the national level are associated not only with the scale of economic development, but also with elements of the national business culture that affect all the company's business processes [21]. Thirdly, hypotheses are put forward on the relationship between the elements of intellectual capital and other indicators. Fourth, an empirical model is developed, it may include elements proposed by the authors or, possibly, independently developed new models. Then, the coefficients in the models are calculated based on the analysis of statistical data. The problem of the lack of relevant statistics on the topic of intellectual capital is solved, as a rule, by the application of structured questionnaires.

The main hypotheses of our study, based on a review of theoretical material, are as follows:

Hypothesis 1. Companies with a high level of intellectual capital are more likely to show high performance, measured by revenue from sales of products or services.

Hypothesis 2. Companies with a high level of intellectual capital are more likely to show high performance, measured by an increase in the company's market share compared to competitors.

For both hypotheses, the observation that the company's performance is one of the direct indicators of the investment attractiveness of the company is true.

3. Intellectual capital measurement: Static and dynamic approach

Measurement of intellectual capital was carried out on the basis of the developed questionnaire, which included four main blocks. The first block included general information about the company and personal information about the employee (information about the position, gender, etc.). The second block of the questionnaire included information about the subjective assessment of the level of competition in the industry by respondents, as well as the presence of seasonal factors. An analysis of these indicators is necessary in order to verify the assumption that in conditions of high competition and a rapidly changing situation in the industry, companies need adaptation; in addition, a high level of competition encourages the company to work more efficiently, which affects the employees' attention to performance indicators. The third block of questions was devoted directly to the performance indicator among which we identified sales growth in the last year compared to competitors and market growth compared to other companies. The fourth block of the questionnaire was devoted to the analysis of three elements of intellectual capital, which were revealed through the level of qualification of employees, motivation and also the availability of information systems in companies. Relational capital was disclosed based on an analysis of employee readiness for cooperation and active interaction of the company with all external stakeholders. Each of the indicators was evaluated on a 7-point Likert scale, where one point means a lowest level of intellectual capital, seven points - the highest level of intellectual capital.

The majority of researchers in the analysis of the transformational role of intellectual capital also indicate a high correlation of the elements of intellectual capital among themselves, which complicates their inclusion in the model as independent variables [9]. Obviously, the elements of intellectual capital play a different role in the transformation process, since some of them are able to act as supporting elements (in conservative models of creating value "chain"), while others are aimed at transforming intellectual resources into new forms for further use.

Unlike previous studies, in our modeling we distinguish two types of capital, namely static intellectual capital, which reflects the resources already accumulated in the company that can be used with high efficiency in the future, and dynamic intellectual capital, which includes those intellectual resources that help create in support of the process of transformation of intellectual capital. For example, the intensification of innovation, increasing the level of cooperation between employees within the company or operations between companies in the market to solve specific problems. An example of static intellectual capital can be the knowledge of employees, which is the result of previous intellec-

tual activity. On the contrary, a high level of employee motivation can become a dynamic element of human capital, which allows them to work with high returns and show a high level of innovative activity or effectively cooperate to solve production problems. The same elements can be highlighted in structural capital, for example, an information system can become a static element, and tools and resources that are used by employees to create new knowledge-intensive products can become dynamic. We focused on software, working “models” and methods within the company. Consequently, the technological component of structural capital is dynamic only when it allows developing new types of intellectual capital on its basis, and not just transforming physical capital from one form to another, for example, increasing the added value of products.

4. Research methods and data

Proposed model is based on the method of nominal logistic regression, which allows to determine the occurrence probability of one factor depending on the presence of other factors. Based on this model, we will confirm two hypotheses of the study, which focuses on a relationship between company’s performance (or productivity), and its intellectual capital. Mathematically logistic model contains a dependent variable that can take only two values (1 or 0). Among these dependent variables, we identified an indicator that reflects the fact of sales growth compared to competitors or an increase in market share compared to other companies. Moreover, using the questionnaire, we identified companies with a high level of performance and a low or moderate level of performance, thus dividing the variable into two values. Companies’ representatives with low and moderate levels of performance evaluate the studied indicators from 1 to 4, where 1 means “a low value of intellectual capital” and 4 means “an intermediate value” (Likert dichotomous scale). At the same time, if these variables took on a value ranging from 5 to 7, then the companies were classified as highly performative.

In our study, we tested four models, each of them contained two specifications: the first specification focused on revenue as a performance indicator, and the second on market share as such an indicator. The independent variables in the 1st and 3rd models included elements of dynamic intellectual capital, and the 2nd and 4th models included indicators of static intellectual capital. The third and fourth models additionally included variables reflecting the high level of competition in the industry, as well as indicating a high level of changes in the business environment. Details and specifications of the models used in the study, as well as questions from the questionnaires are given in Table 1.

Table 1. List of variables in the applied models and their interpretation.

Variable code	Question	Type of intellectual capital	Model 1	Model 2	Model 3	Model 4
COMP_HI	Do you agree with the statement (hereinafter): the level of competition in the industry is high.	n.a.			Yes	Yes
COMP_CHAN	The situation in the industry is changing rapidly. Fast adaptation needed	n.a.			Yes	Yes
PERF_SAL	Our company succeeded in sales growth last year	n.a.	Dependent (1.1)	Dependent (2.1)	Dependent (3.1)	Dependent (4.1)

	(compared to competitors)					
PERF_MARK	... increased market share last year (compared to other companies)	n.a.	Dependent (1.2)	Dependent (2.2)	Dependent (3.2)	Dependent (4.2)
IC_HC_2	Our employees are highly motivated, working with dedication	Dynamic	Yes		Yes	
IC_HC_3	... have a high level of specialized knowledge and education in their professional field	Static		Yes		Yes
IC_SC_1	Our company has an effective and useful information system to support business operations.	Static		Yes		Yes
IC_SC_2	... tools and resources that increase the level of cooperation between employees	Dynamic	Yes		Yes	
IC_RC_2	Our employees are ready for mutual cooperation to solve the problems of the company (internal environment)	Dynamic	Yes		Yes	
IC_RC_3	Internal cooperation runs smoothly (without destructive disagreements) (internal environment)	Static		Yes		Yes
IC_RC_5	The company often collaborates with other compa-	Dynamic	Yes		Yes	

	nies in the market to solve competi- tive problems (external envi- ronment)			
IC_RC_6	The company easily interacts with all exter- nal stakehold- ers, the inter- action goes smoothly (ex- ternal envi- ronment)	Static	Yes	Yes

Data used in the study were collected by the authors for 2 years (in 2018 and 2019) on the basis of a questionnaire integrated into the Google Forms platform. This collection method allows to get complete questionnaires with the required data, which are then easily processed and used in further research. In total, over the period, 412 questionnaires were received from workers of various industries. We divided all the profiles into two sectors, namely, industrial organizations and service sector organizations. All of these models were initially calculated for the entire sample size. The sample included both representatives of the managerial staff and ordinary employees of the company. In total, the survey involved employees and 25 Russian companies from two local regions of the Russian Federation (Sverdlovsk and Chelyabinsk regions).

5. Results and discussion

In the questionnaire, in particular, we asked the respondents whether they had encountered the concept of intellectual capital in the practice of managing the company. Only 12.4% of all respondents answered that their enterprises regularly plan intellectual capital management events in one or another way, while a third of all respondents said that they had never encountered such a concept in practice. Moreover, 27% of respondents said that they have only a theoretical idea of intellectual capital and never use it in practice. An analysis of the answers to this question confirms the assumptions made in the theoretical part of the study. Companies' management in Russian conditions does not use the concept of intellectual capital in practice, and therefore it is necessary to apply indirect questions in the questionnaire about the facts of economic activities or about the quality level of intellectual resources that the companies have at their premises. Indirect questions indicate the presence of intellectual capital in companies.

The next issue investigated was understanding of intellectual capital: the vast majority of respondents identified two key elements, such as intellectual property (which we attribute to structural capital), as well as company employees, their knowledge and competencies, which we interpret as human capital. Only 8% of all respondents identified elements such as social responsibility, cooperation and organizational culture as part of intellectual capital. Despite the fact that a significant number of respondents did not encounter the concept of intellectual capital in practice, intuitively many were able to identify its key elements.

Just over half of all respondents believe that intellectual capital is a significant factor in production process, third of respondents suggest that this assumption is possible. Only 5% of employees say that intellectual capital is definitely not a significant factor in production. Among the companies that show high performance in terms of both revenue and market share, a greater number of respondents note that intellectual capital management projects are implemented in their companies in practice and a significantly smaller number of respondents among such organizations note that they never faced with

the concept of intellectual capital. This notion is true for both service organizations and industrial enterprises equally (see Figure 1).

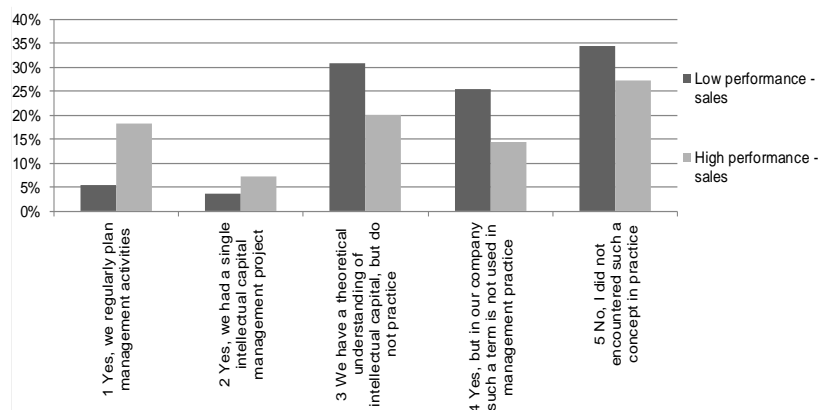


Figure 1. Perception of intellectual capital for service and industrial companies in terms of sales.

Most respondents also answered that if it is required intellectual capital to become a competitive advantage of a company, employee training is necessary, and management must reflect the essence of intellectual resources in their minds. To a much lesser extent, respondents noted that external factors affect intellectual capital, among such factors - the need to improve the economic situation in the country and develop partnerships with suppliers (see Figure 2).

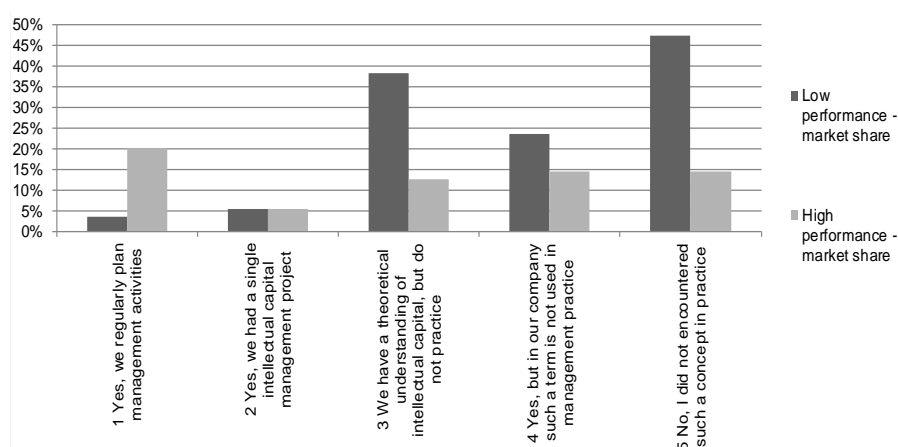


Figure 2. Perception of intellectual capital for service and industrial companies in terms of market share.

As the results of the analysis show, models based on the adoption of proceeds from the sale of products or services as an indicator of the performance of companies have low explanatory power, the share of the total explained variance for them does not exceed 17%. The quality indicators of the models for the “revenue from sales” block show that the model is significant, the Cox and Snell R-square and the Nielkirk R-square are analogues of the pseudo R, which can be taken as a share of the explained variance. The share of the explained classification reflects the percentage of observations that were correctly classified during the application of the model. A rate of over 60% is acceptable for social models.

The results of the model evaluation can be interpreted as moderate; as a result, the hypothesis 1 is partially confirmed (see **Table 2**). In all models, it is clear that high rates of intellectual capital increase the company's chances to become one of the highly performative enterprises. Moreover, among

the dynamic elements of intellectual capital, the most important role is played by employee motivation, among the elements of relational capital, cooperation with other companies in the market for solving competitive problems plays a high role.

Table 2. Statistical quality indicators for models focusing on "revenue" performance.

Indicator	Model 1	Model 2	Model 3	Model 4
Chi square	17,8	36,2	19,5	31,9
Degrees of freedom	8	8	8	8
Cox and Snell R-Square	0,11	0,09	0,13	0,13
R square Nielkirk	0,10	0,12	0,17	0,17
The total percentage of the explained classification, %	63,1	67,3	68,0	63,1
Explained with low revenue, %	69,1	56,3	76,4	65,5
Explained with high revenue, %	56,3	62,1	58,3	60,4
Number of valid observations	412	412	412	412

Analysis shows that a high level of competition also encourages companies to "keep the bar high", to fall into the category of highly productive, which is especially evident in model 4. Among the static elements of human capital, a high level of special knowledge of employees and education in their professional field play a key role. In model 4, we see that the presence of this indicator increases the likelihood of a company getting productive 1.4 times (only significant coefficients are analyzed at an error level of less than 1%). To analyze the coefficients in the logistic model, you need to raise e to a power that corresponds to the coefficient (see

Table 3).

Table 3. Results of analysis of models for the block "revenue" - the coefficients of the binomial logistic regression.

Variable, step and input method		B	Std. error	Wald	Sign.	Exp (B)
Variables in Model 1 - revenue from sales of products, services						
Step 1 - variable input method (dynamic IC)	IC_HC_2	,431	,092	22,024	,000	1,539*
	IC_SC_2	,013	,087	,024	,878	1,013
	IC_RC_2	-,111	,092	1,444	,229	,895
	IC_RC_5	-,010	,075	,019	,890	,990
	Constant	-1,542	,436	12,519	,000	,214
Variables in Model 2 - revenue from sales of products, services						
Step 1 - variable input method (static IC)	IC_HC_3	,358	,115	9,736	,002	1,430*
	IC_SC_1	,055	,082	,447	,504	1,056
	IC_RC_3	-,289	,109	7,063	,008	,749
	IC_RC_6	,339	,094	12,969	,000	1,404*

Variable, step and input method		B	Std. error	Wald	Sign.	Exp
Constant		-2,432	,469	26,950	,000	,088
Variables in Model 3 - revenue from sales of products, services						
Step 1 - variable input method (dynamic IC)	IC_HC_2	,182	,097	3,502	,061	1,199
	IC_SC_2	,134	,097	1,920	,166	1,143
	IC_RC_2	,309	,103	9,049	,003	1,362*
	IC_RC_5	,172	,089	3,719	,054	1,187
	COMP_HI	,062	,111	,316	,574	1,064
	COMP_CHAN	,259	,091	8,193	,004	1,296*
	Constant	-5,823	,695	70,289	,000	,003
Variables in Model 4 - revenue from sales of products, services						
Step 1 - variable input method (static IC)	IC_HC_3	,348	,122	8,176	,004	1,416*
	IC_SC_1	,017	,085	,038	,845	1,017
	IC_RC_3	-,225	,112	4,049	,044	,799
	IC_RC_6	,304	,097	9,849	,002	1,355*
	COMP_HI	,405	,101	16,131	,000	1,499*
	COMP_CHAN	-,181	,081	4,957	,026	,835
	Constant	-3,453	,588	34,524	,000	,032

Analysis of models that are based on the assumption that company performance can be measured based on market share also shows the moderate impact of intellectual capital on company performance (hypothesis 2). Among the considered models, static intellectual capital models have the greatest explanatory power; the share of the explained variance is slightly more than 30% for the mixed version. The percentage of predicted values among a company with high revenue reaches 80%, which is an acceptable level (see Table 4).

Table 4. Model quality indicators for the “market share” performance dimension.

Indicator	Model 1	Model 2	Model 3	Model 4
Verification of Khosmer-Lemeshev consent:	---	---	---	---
Chi square	18	93	22	58
Degrees of freedom	8	8	8	8
Cox and Snell R-Square	0,18	0,20	0,20	0,23
R square Nielkirk	0,25	0,27	0,28	0,32
The total percentage of the explained classification, %	69,1	76,7	76,4	80,4
Explained with low market share, %	56,3	86,4	58,3	64,9
Explained with high market share, %	63,1	59,5	68,0	89,6
Number of valid observations	412	412	412	412

Analysis of the coefficients shows that among the dynamic elements of intellectual capital that affect the performance expressed through market share, the most important are the elements of relational capital, in particular, in this model, indicators of internal cooperation between company employees are

of great importance. Among the elements of static intellectual capital, structural capital is also of great importance, namely the availability of effective useful information systems to support business operations. Human capital also plays a moderate role in shaping performance. The last of the considered models, which is mixed and based on the assumption that performance is related to market share, shows that interaction with stakeholders increases the likelihood of a company becoming productive by 1.4 times, which conceptually coincides with the results obtained from models based on revenue indicators (see

Table 5).

Table 5. Results of analysis of models for the block “revenue” - the coefficients of the binomial logistic regression.

Variables, steps and input methods		B	Std. error	Wald	Sign.	Exp (B)
Variables in Model 1 – market share of the company						
Step 1 - variable input method (dynamic IC)	IC_HC_2	,237	,095	6,153	,013	1,267
	IC_SC_2	,166	,094	3,141	,076	1,181
	IC_RC_2	,358	,099	12,982	,000	1,431
	IC_RC_5	,197	,084	5,494	,019	1,218
	Constant	-4,896	,589	69,105	,000	,007
Variables in Model 2 – market share of the company						
Step 1 - variable input method (static IC)	IC_HC_3	,211	,134	2,482	,115	1,235
	IC_SC_1	,315	,092	11,784	,001	1,370
	IC_RC_3	,111	,120	,865	,352	1,118
	IC_RC_6	,396	,106	14,047	,000	1,486
	Constant	-5,364	,615	76,105	,000	,005
Variables in Model 3 – market share of the company						
Step 1 - variable input method (dynamic IC)	IC_HC_2	,182	,097	3,502	,061	1,199
	IC_SC_2	,134	,097	1,920	,166	1,143
	IC_RC_2	,309	,103	9,049	,003	1,362
	IC_RC_5	,172	,089	3,719	,054	1,187
	COMP_HI	,062	,111	,316	,574	1,064
	COMP_CHAN	,259	,091	8,193	,004	1,296
	Constant	-5,823	,695	70,289	,000	,003
Variables in Model 4 – market share of the company						
Step 1 - variable input method (static IC)	IC_HC_3	,131	,142	,840	,359	1,139
	IC_SC_1	,318	,094	11,584	,001	1,375
	IC_RC_3	,083	,127	,429	,512	1,086
	IC_RC_6	,358	,106	11,451	,001	1,431
	COMP_HI	,077	,109	,494	,482	1,080
	COMP_CHAN	,286	,092	9,708	,002	1,331
	Constant	-6,531	,761	73,566	,000	,001

6. Conclusion

The modern management theory implies that intellectual capital is a key strategic resource of the company, information about which acts as a kind of indicator reflecting the future potential of the company. In this study, qualitative research methods are applied to support this hypothesis on the basis of an empirical investigation conducted using sociological survey method. Binomial logistic regression models are used to analyze the probability of increasing the investment attractiveness of the company as a result of dynamic and static components of intellectual capital implementation and maintenance. All investigated companies were conditionally divided into high-performance and low-performance, as a result, a stable relationship between the investment attractiveness of the company and the use of such elements as human, structural and relational capital was shown. Companies that succeed in the market to a greater extent use elements of relational and structural capital to achieve a competitive advantage, establishing stable relationships with consumers. Moreover, the return on static elements of intellectual capital, which reflect the actually accumulated volume of company resources during the previous period, is slightly higher than the return on its dynamic components.

In our study, we examined investment attractiveness indicators through the prism of financial indicators that reflect the company's ability to generate income over the period (that is, the company's revenue), as well as reflecting the ability to increase market share. A positive moderate relationship between investment attractiveness and the components of intellectual capital suggests that it is necessary to develop practical methods and recommendations for updating the general strategies used by enterprises on the basis of integration and improving the elements of intellectual capital in the framework of companies' investment activity.

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